Ministry
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MI-116

SURFACE TREATMENT TEST SECTIONS WITH POLYMER-MODIFIED EMULSIFIED ASPHALT

MATERIALS INFORMATION
ENGINEERING MATERIALS OFFICE

MINISTRY OF TRANSPORTATION
ONTARIO

SURFACE TREATMENT TEST SECTIONS

WITH POLYMER-MODIFIED

EMULSIFIED ASPHALT

R. C. Aquin, P. Korgemagi, D. F. Lynch

Bituminous Section
Engineering Materials Office
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1 . INTRODUCTION

Modification with polymer enhances the low and high temperature properties of asphalt cement. Surface treatments constructed with polymer-modified binders are claimed to provide better initial and long term aggregate retention, increased resistance to flushing and longer surface treatment life. They are also claimed to permit surface treatment under a wider variety of weather conditions.

Eight surface treatments were placed using polymer-modified high float emulsion in Northern and Northwestern Regions in 1987. The trials were part of the routine construction and maintenance surface treatment programs and special criteria were not used when selecting the locations. Styrelf ™ HF-150P emulsified asphalt was used on all the 1987 trials.

The purpose of the trials was to determine if polymer-modified high float emulsions could be used under normal construction procedures and to monitor the claims of improved performance. The control sections, the main portion of the contracts, were built with standard HF-150S emulsified asphalt next to the trial sections. The trial and the control sections will be monitored for performance annually.

2. POLYMER-MODIFIED EMULSIFIED ASPHALTS

Polymers are large molecules made by the repetitive combination of a large number of simpler identical units called monomers. Some types of polymers used to modify asphalts are rubber, neoprene, styrene-butadiene rubber (SBR) and styrene-butadiene (SBS).

The physical properties of asphalt binders are improved when modified with polymers. Modified binders are claimed to be less brittle in winter, less apt to flow in summer, and to have better adhesion, cohesion and elastic properties than standard asphalts.

HF-150P emulsified asphalt was used in the trials. The asphalt cement was modified with a styrene-butadiene block co-polymer in Michigan using the Styrelf ™ process. The emulsified asphalt was manufactured in Toronto by McAsphalt Industries Ltd. Polymer-modified emulsified asphalts will be available from several Ontario emulsion manufacturers in 1988.

3 . CONSTRUCTION

Eight surface treatments were constructed in 1987 with polymer-modified HF-150P emulsified asphalt. The following is a description of each installation. Tables 1 and 2 in the appendix list the surface treatment type, the average and desired binder application rates and the AADT of each trial and control section. Tables 3 and 4 show the location and length of the trial and control sections.

Hwy. 129

Hwy. 129 is a two lane facility with an AADT of 300. The roadway surface was restored by adding granular "A" at the rate of approximately 45 m^3 per km. The granular grade was dampened, graded and compacted prior to placing the double surface treatment (DST).

The polymer-modified DST was placed on June 22, 1987 at the north limit of the contract by Royel Paving Ltd. Two hydrostatic drive distributors were used to spray the HF-150P. The average rate for the two applications of HF-150P was 3.22 kg/m^2 (3.25 kg/m^2 desired). Granular "A", Type II was used in place of the Class 2 aggregate on the initial application due to shortage of Class 2 aggregate. The Granular "A" was placed at an average rate of 19.2 kg/m^2 (18-19 kg/m^2 desired) and the Class 2 aggregate was placed on the second application at an average rate of 17.2 kg/m^2 (16.5- 19.0 kg/m^2 desired). Rolling was done with two 8 t rubber-tired rollers and one single drum vibratory roller. Traffic was convoyed with a pilot vehicle.

The sprayed HF-150P was observed by the construction personnel to leave dime sized areas of granular showing through the emulsion prior to the application of aggregate. McAsphalt personnel requested that the application of aggregate be delayed 150 m to 270 m to allow the HF-150P to flow into the areas, but no improvement was observed. Specification 304 requires a maximum of 30 m between the distributor and the spreader. The untreated areas were not reported in the control section with the standard emulsion.

Clogging of the distributor spray nozzles was reported with one of the three tanker loads of HF-150P. The contractor suspected that the tanker may have been contaminated.

The control section of DST started at the south end of the trial section and continued southerly 4.8 km. The granular grade condition and preparation was similar to the trial section. The approximate rate was 3.20 kg/m^2 (3.25 kg/m^2 desired) for the HF-150S. Granular A was used on the initial application and Class 2 aggregate on the second application at rates similar to the control section. Rolling was done with two 8 t rubber-tired rollers and one single drum vibratory roller. Traffic was convoyed with a pilot vehicle.

Hwy. 540

Hwy. 540, at Gore Bay on Manitoulin Island, is a two lane surface treated road with an AADT of 700. Two sections of Hwy. 540, 2.2 km apart, were reconstructed by District maintenance forces. Each section was primed and single surface treated (SST). The westerly section was sprayed with HF-150S and was designated as the control section. The easterly section was sprayed with HF-150P.

The trial section was primed by MSO Construction Ltd. the week of August 3rd. The emulsified asphalt primer, SP-6, had penetrated into the granular grade 10 to 13 mm. There were no potholes in the prime prior to placing the SST.

MSO Construction Ltd. swept the prime and placed the HF-150P trial section using two hydrostatic drive distributors on August 13th. The average application rate was 1.49 kg/m^2 (1.50 kg/m^2 desired) for the HF-150P and 23.2 kg/m^2.(16.5-19.0 kg/m^2 desired) for the Class 2 aggregate. The higher aggregate rate was required to prevent the HF-150P emulsion from sticking to the equipment tires. Rolling was done with two rubber-tired 8 t rollers. Traffic was convoyed with a pilot vehicle. Problems were not encountered when spraying the HF-150P emulsion.

The intersection of Hwys. 540 and 540B (west junction), within the test section, had been surface treated with HF-150S the evening before, so that the intersection received two applications of surface treatment.

The control section was primed with SP-6 the same day as the trial section and was in similar condition to the trial section. The average application rates for the SST were: HF-150S at 1.47 kg/m^2 (1.50 kg/m^2 desired) and Class 2 aggregate at 18.8 kg/m^2 (16.5-19.0 kg/m^2 desired). The placing and rolling procedures used were the same as for the polymer trial section.

Hwy. 551

Hwy. 551, at Providence Bay on Manitoulin Island, was an existing two lane surface treatment with an AADT of 500. The existing surface treatment was reported to be in good condition and had received only minor spray patching prior to surface treating.

The SST trial section was placed by MSO Construction Ltd. in the 3rd week of August. HF-150P was sprayed at 1.54 kg/m^2 (1.50 kg/m^2 desired) and the Class 2 was applied at 21.9 kg/m^2 (16.5-19.0 kg/m^2 desired), the overrun was reported to be due to the HF-150P sticking to the equipment tires. Rolling was done with two 8 t rubber-tired rollers. Construction problems were not reported when using the polymer HF-150P emulsion for SST. Traffic was convoyed with a pilot vehicle.

The control section received a SST with HF-150S over the existing surface treatment. HF-150S was sprayed at approximately 1.50 kg/m^2 (1.50 kg/m^2 desired) and the Class 2 aggregate was applied at approximately 18 kg/m^2 (16.5-19.0 kg/m^2 desired). Rolling and traffic control were the same as in the trial section.

Hwy. 560

Hwy. 560, east of Elk Lake, is a two lane highway with an AADT of 150. The granular grade was reconstructed by the District maintenance forces in 1986 and was in good condition. Prior to the application of the double surface treatment, the granular grade was watered, lightly graded and rolled with a steel-tired roller.

The trial section of DST was placed on July 29 and 30, 1987. Bruell Construction Ltd. used one Etnyre hydrostatic drive distributor to spray the HF-150P. The average HF-150P application rate was 3.04 kg/m^2 (3.12 kg/m^2 desired). No problems were encountered when spraying the HF-150P emulsion. The Class 2 aggregate averaged 43.9 kg/m^2 (35 kg/m^2 desired). The overrun was attributed to excessively wet aggregate and to the tackiness of the HF-150P emulsion. Rolling was done with one 8 t rubber-tired roller and one 7 t tandem steel-tired roller. Traffic was convoyed with a pilot vehicle.

The polymer-modified emulsion had a much quicker set than the standard HF-150S emulsion. This was quite noticeable when a larger aggregate particle was pried from the road about 5 min after rolling.

The DST in the control section was placed on July 27 to July 29, 1987. The granular grade condition and preparation were similar to those used on the test section. The average application rate was 3.00 kg/m^2 (3.12 kg/m^2 desired) for the HF-150S and 41.9 kg/m^2 (35 kg/m^2 desired) for the Class 2 aggregate. The overrun was due to excessively wet aggregate. The equipment and procedures were the same as in the test section.

Hwy. 560, 4.7 km west of Elk Lake, received a single surface treatment with HF-150P on July 30, l987, in the eastbound lane only. The SST trial section, 1.2 km in length, was placed over the existing surface treatment to stop the severe bleeding and small areas from being picked up by traffic. The polymer-modified HF-l50P was sprayed at 0.94 kg/m^2 (1.00 kg/m^2 desired). Class 2 aggregate was spread and rolled.

Control sections of SST were placed at various locations in the eastbound lane, from Elk Lake westerly 9.3 km. The control sections were placed to cover the existing bleeding surface treatment. HF-150S was sprayed at approximately 1.0 kg/m^2 (1.00 kg/m^2 desired). Class 2 aggregate was spread and rolled.

FIGURE 1: HWY. 560, SPRAYING POLYMER-MODIFIED HF-150P

FIGURE 2: HWY. 560, SPREADING CLASS 2 AGGREGATE

FIGURE 3: HWY. 560, COMPACTING CLASS 2 AGGREGATE

FIGURE 4: HWY. 560, BLEEDING SURFACE PRIOR TO PLACING SST

Hwy. 575

Hwy. 575 is a two lane facility with an AADT of 550. Construction was completed in August, 1987 under Contract 86-200, which called for grading, drainage and granular base. Calcium chloride had been applied to the granular grade as part of Contract 86-200. The road had been graded but not watered or rolled and was noted to be rough prior to placing the double surface treatment.

The North Bay (Ministry) surface treatment crew placed the DST trial section on August 25th to 28th using the polymer-modified HF-150P emulsion. The Etnyre distributor was the rear engine driven pump model. The HF-150P was sprayed at 2.81 kg/m^2, the average of Aug. 25, 26, and 27, (2.95 kg/m^2 desired) for the two applications. North Bay historically spray lower binder

rates. Class 2 aggregate was spread at an average of 36.7 kg/m^2 (35 kg/m^2 desired). Rolling was done with one 8 t rubber-tired and one tandem steel-tired roller. Traffic was convoyed with a pilot vehicle.

The HF-150P emulsion was observed to be breaking very quickly. McAsphalt Industries Ltd., the emulsion manufacturer, had left instructions to delay the application of Class 2 aggregate; the spreader was operating about 50 m behind the distributor. The North Bay crew usually follow about 10 m behind the distributor when using regular HF-150S emulsion. The Ministry Specification 304 specifies a maximum of 30 m between the distributor and spreader.

The DST control sections with the HF-150S emulsion were located north and south of the test section. The granular grade was prepared in the same manner as the polymer test section. The DST on the lower 2.1 km of the southerly control section was placed on August 11th, about two weeks prior to the polymer and remaining control sections. The HF-150S rates for the control sections were approximately 2.9 kg/m^2 (2.95 kg/m^2 desired). The Class 2 aggregate was applied at approximately 35 kg/m^2 (35 kg/m^2 desired). The spreader was operating at the usual distance of about 10 m from the distributor. Rolling and other procedures were the same as on the test section.

Hwy. 583

Hwy. 583, south of Hearst, is a two lane highway with an AADT of 150. The granular grade was constructed by the District maintenance forces.

The polymer DST test section was placed on August 4th by the Cochrane (Ministry) surface treatment crew. The HF-150P emulsion was sprayed at an average rate of 3.12 kg/m^2 (3.20 kg/m^2 desired) and the Class 2 aggregate was applied at 42 kg/m^2 or about 20% higher than the standard rate of 35 kg/m^2. Rolling was done with one 8 t rubber-tired roller and one 7 t tandem steel-tired roller. Traffic was convoyed with a pilot vehicle. Problems were not reported using the HF-150P emulsified asphalt.

The control section was located south of the test section. The granular grade condition and preparation were similar to those of the test section. The approximate application rates were 3.15 kg/m^2 (3.20 kg/m^2 desired) for the HF-150S and 35 kg/m^2 (35 kg/m^2 desired) for the Class 2 aggregate. Placing and rolling procedures were the same as the test section.

Hwy. 631

Hwy. 631, south of Hornepayne, is a two lane highway with an AADT of 200. The roadway surface was restored under Contract 87-203. Prior to the application of double surface treatment, the granular grade was watered, graded and rolled.

The trial section on Hwy. 631 was placed on July 27 and 28, 1987, at the Shekak River bridge. Royel Paving placed the DST 8.5 m wide on the initial application (constructed in three passes) and 7.3 m wide on the second application (constructed in two passes). The surface treatment widths were wider than the standard widths of 6.5 to 7.0 m to reduce shoulder maintenance and edge breakage. The average application rate for the HF-150P was 3.14 kg/m^2 (3.05 kg/m^2 desired) and for the Class 2 aggregate was 33.9 kg/m^2 (35 kg/m^2 desired). Rolling was done with two 8 t rubber-tired rollers and

one single drum vibratory roller. Traffic was convoyed with a pilot vehicle. Problems were not reported handling or spraying the HF-150P emulsion.

The DST control sections were located north and south of the test section. The granular grade condition and preparation were similar to the test section. Surface treatment widths were also 8.5 and 7.3 m. The application rate was approximately 3.1 kg/m^2 (3.05 kg/m^2 desired) for the HF-150S and 35 kg/m^2 (35 kg/m^2 desired) for the Class 2 aggregate. Placing and rolling procedures were the same as the test section.

4. COST

In the Elk Lake area, the actual cost[1] of double surface treatment was $14,500 per km using polymer-modified HF-150P and $12,000 per km using the standard HF-150S emulsion. This is an increase of 21% over the cost of double surface treatment with the standard HF-150S emulsion. On Manitoulin Island, the actual cost[1] of single surface treatment was $7,430 per km using HF-150P and $6,000 per km using HF-150S emulsion. This is an increase of 24% over the cost of SST with HF-150S emulsion.

Part of the increase is explained by the higher shipping charges of approximately $3.50/km for the HF-150P; the HF-150P came from Toronto and the HF-150S came from North Bay, a difference of 330 km.

5. EMULSIFIED ASPHALT TEST RESULTS

The polymer-modified HF-150P emulsion was sampled at the jobsite and tested within 14 days. All of the 13 samples failed one or more of the tests, refer to Table 5. Most of the failures were due to an unstable emulsion that broke in the shipping container prior to testing. The emulsion, however, did not cause any handling or spraying problems on the job.

All the samples of standard HF-150S used in the control sections conformed to the specification requirements. Refer to Table 6.

A manufacturer's specification for the polymer-modified HF-150P was obtained from Elf Aquitaine, refer to Table 7.

6. OBSERVATIONS

Late in November 1987, potholing was observed on Hwy. 575 over the entire 9.6 km of DST. The potholes had occurred at the centreline joint and typically were 10 to 30 cm wide by 10 m in length. There were 1.5 potholes per kilometre in the southerly control section, 8.3 in the polymer trial section and 5.0 in the northerly control section. See the memorandum dated 87 12 17 in the appendix. A quick telephone survey of the other polymer trial sections found them to be in satisfactory condition, however, some of the roads were covered with snow.

The following observations were made during the construction of the trial and control sections:

1. Problems were not encountered handling or spraying the polymer-modified HF-150P emulsified asphalt.

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[1] Includes 7% Ontario Retail Sales Tax, but excludes overhead for engineering, inspection, etc.; width of double surface treatment 6.7 m.

2. The HF-150P emulsified asphalt had a very fast initial break.

3. The HF-150P adhered well to the aggregate.

4. The HF-150P did not wet the aggregate or migrate upwards during compaction as well the HF-150S.

5. Binder rates were similar for both emulsion types.

6. Approximately 5% more Class 2 aggregate was required with the HF-150P.

7. The manufacturer suggested a delay in applying the aggregate with the HF-150P.

8. Laboratory tests showed that the HF-150P did not conform to the manufacturer's specification requirements.

9. Early performance problems with the test and control sections were encountered on one contract.

7. PERFORMANCE CRITERIA

The test sections and control sections will be monitored annually for performance. The surface treatment condition rating form, Figure 7, will ensure that the surface treatments are rated uniformly. The form lists five defects common to surface treatments with Class 2 aggregate. The average condition rating will be obtained annually for each trial and control section.

8. CONCLUSIONS

1. Surface treatments with HF-150P can be successfully constructed using current equipment and techniques.

2. The short term performance of the test sections is satisfactory.

3. Performance of the test and control sections should be monitored annually.

4. Single surface treatment overlays are frequently placed the year following construction by the Districts. HF-150P is the recommended binder for test section overlays and HF-150S for control section overlays so that the roads can continue to be monitored annually.

5. A material specification for polymer-modified emulsified asphalts is required.

APPENDIX

TABLE 1: HF-150P POLYMER-MODIFIED TRIAL SECTIONS

Hwy. No.	Contract /District	Surface Treatment Type	Average Binder Rate, kg/m2	Desired Binder Rate, kg/m2	Year Contructed	AADT 1986
129	87-216	DST	3.22	3.25	1987	300
540	87-553	P&ST(1)	1.49	1.5	1987	700
551	87-553	SST	1.54	1.5	1987	500
560	87-522	DST	3.04	3.12	1987	150
560	87-522	SST(2)	0.94	1	1987	225
575	190-80-02	DST	2.81(3)	2.95	1987	550
583	District 16	DST	3.12	3.2	1987	150
631	87-203	DST	3.14	3.05	1987	200

Notes:
(1) P&DST at intersection of Hwys. 540 & 540B.
(2) Placed over a bleeding surface treatment.
(3) The average of Aug. 25, 26 & 27.

TABLE 2: HF-150S CONTROL SECTIONS

Hwy. No.	Contract /District	Surface Treatment Type	Average Binder Rate, kg/m2	Desired Binder Rate, kg/m2	Year Contructed	AADT 1986
129	87-216	DST	3.2(2)	3.25	1987	300
540	87-553	P&ST(1)	1.47	1.5	1987	700
551	87-553	SST	1.5(2)	1.5	1987	500
560	87-522	DST	3	3.12	1987	150
560	87-522	SST(3)	1(2)	1	1987	225
575	190-80-02	DST	3(2)	2.95	1987	550
583	District 16	DST	3.15(2)	3.2	1987	150
631	87-203	DST	3.1(2)	3.05	1987	200

Notes:
(1) Prime and single surface treatment.
(2) Approximate.
(3) Placed over a bleeding surface treatment.

TABLE 3: POLYMER-MODIFIED TRIAL SECTION LOCATIONS

Hwy. No.	Location
129	From 88.4 km north of Hwy. 554, northerly 4.6 km.
540	From Jct. Hwy. 542 westerly 2.9 km.
551	From 1.3 km south of west Jct. Hwy. 542, southerly 3.0 km.
560	From 6.5 km east of Elk Lake, easterly 1.5 km.
560	EB lane, from 4.7 km west of west Jct. 65 & 560, westerly 1.2 km.
575	From 10.9 km north of Hwy. 17, northerly 6.0 km.
583	From 1.8 km south of Jogues southerly 1.7 km (150 m south of RR tracks).
631	From 0.7 km south of Shekak River Bridge northerly 4.4 km.

TABLE 4: CONTROL SECTION LOCATIONS

Hwy. No.	Location
129	From 83.6 km north of Hwy. 554, northerly 4.8 km.
540	From 5.1 km west of Jct. Hwy. 542, westerly 1.4 km.
551	From west Jct. of Hwy. 542, southerly 1.3 km.
560	From Elk Lake easterly 6.5 km.
560	EB lane, various sections, from west Jct. 65 & 560 westerly 9.3km.
575	From 8.3 km north Hwy. 17, northerly 2.6 km;
575	From 16.9 km north Hwy. 17, northerly 1.0 km.
583	From 3.5 km south of Joques, southerly 4.5 km.
631	From 0.7 km south Shekak River Bridge, southerly 4.0 km;
631	From 3.7 km north Shekak River Bridge, northerly 4.0 km.

TABLE 5: HF-150P POLYMER-MODIFIED TEST RESULTS

Contract/W.P.	190-80-02	190-80-02	190-80-02	190-80-02	87-553	District16	87-203	87-203	87-203	87-216	87-216	87-216	87-522
Hwy. No.	575	575	575	575	540	583	631	631	631	129	129	129	560
Lab. No.	H 76	H 77	H 78	H 82	H57	E-51	4109	4110	4111	4028	4029	4030	E-36
Residue,%	67.6	67.6	68.4	68.4	65.9	(#2)	(#2)	(#2)	(#2)	68	68	68.1	71.9
Oil,%	1.75	1.25	1.25	1	1	(#2)	(#2)	(#2)	(#2)	1.5	1.5	1.5	1
Visc. at 50°C,SFs	22.7	24.4	26.6	25.6	42	(#2)	(#2)	(#2)	(#2)	50.9	46.7	49.1	35
Sieve Test,%	0.31	0.21	(#1)	(#1)	0.01	(#2)	(#2)	(#2)	(#2)	0	0.01	0.01	0.24
Stor., Stab.,1Day,%	6	3.95	1.2	5.6	-0.1	(#2)	(#2)	(#2)	(#2)	-0.4	-0.2	0.1	0.4
Dem.,%	95.7	96.5	94.9	95.3	77.5	(#2)	(#2)	(#2)	(#2)	91.2	95.4	93.9	(#3)
Res., Pen.,	97	92	86	87	128	(#2)	(#2)	(#2)	(#2)	149	138	146	159
Res., Float,s	1200+	1200+	1200+	1200+	1200+	(#2)	(#2)	(#2)	(#2)	1200+	1200+	1200+	1200+
Elastic Rec.,%	50.4	49.6	50	50	48	(#2)	(#2)	(#2)	(#2)	56.2	54.5	57.5	-
Visc. at 60°C,Pa.s	387	415	440.5	435	450	(#2)	(#2)	(#2)	(#2)	410	407	373	516

Notes:
(1) Material would not go through sieve.
(2) Material completely broken, unable to test.
(3) Sample was partially broken.
(4) Refer to the temporary specification in the appendix.

TABLE 6: HF-150S TEST RESULTS

Contract/W.P.	87-216	87-216	87-553	87-553	87-522	87-522	190-80-02	190-80-02	Dist. 16	Dist. 16	87-203	87-203	OPSS 1103	
Hwy. No.	129	129	540	540	560	560	575	575	583	583	631	631	Mar.	1986
Lab. No.	4031	4032	E-58	E-59	E-31	E-32	E-45	E-46	E-50	E-52	4113	4114	Min.	Max.
Residue, %	64.5	64.4	64.8	64.7	64.7	65	64.7	65.3	62.3	64.3	63.1	64.7	62	-
Oil, %	1.5	1.5	1	1.3	1.3	1	1	1	1	1	2.5	2	0.5	4
Visc. at 50°C, SFs	65.6	66.1	63.9	65.8	73.9	77.3	71.6	62.1	36.3	94.7	54.6	86	35	150
Sieve Test, %	0.01	0.01	0.03	0.05	0.04	0.02	0.01	0.07	0	0	0.01	0.02	0	0.1
Stor. Stab.,1Day,%	-0.2	0.5	0.1	0.3	-0.1	0	-0.4	0	0	0.7	0.8	-0.2	0	1.5
Dem., %	92.4	91.1	89.5	87.2	79.9	80.4	80.5	83.3	77.3	80.1	86.2	83.5	75	-
Res., Pen.,	192	202	163	215	178	212	188	207	178	166	184	185	150	250
Res., Float, s	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200+	1200	-
Visc. at 60°C, Pa.s	327	284	276	232	450	500	379	264	575	501	460	402	-	-

TABLE 7: MANUFACTURER'S SPECIFICATION FOR HIGH FLOAT POLYMERIZED EMULSIFIED ASPHALT

TEST	HF150S-P MIN	MAX
Viscosity @ 50°C SSF	35	150
Sieve Test % By Mass	-	0.1
Storage Stability Test 24 h, % By Mass	-	1.0
Demulsibility 0.1 N Ca Cl_2 %	75	
Residue By Distillation @ 204 °C (1) % By Mass	62	-
Oil Portion of Distillate By Volume	0.5	4
TESTS ON RESIDUE		
Penetration @ 25°C 100 gm 5 sec	150	250
Float Test @ 60°C	1200	-
Absolute Viscosity @ 60°C PaSec	As Outlined on Chart	
Solubility in Trichloroethylene %	97.5	-
Elastic Recovery % min	60	-

(1) Maximum Temperature To Be 204°C ± 5°C

memorandum

Tel. 235-3716

Ontario

To: Mr. W. Kmet
District Engineer.
District 13, North Bay

Date 87 12 17

Att'n: J. Porter

From: Bituminous Section
Room 317, Central Bldg

File: 638
Dist. 13

Re: Double Surface Treatment, Hwy. 575

Hwy. 575 received a double surface treatment (DST) for 9.6 km in August, 1987. The construction of Hwy. 575 had just been completed in early August under Contract 86-200 and the lower 2.1 km of DST had been placed about 87 08 11. The remaining 7.5 km of DST had been placed two weeks later from 87 08 25 to 31. A 6.0 km section of the DST was a trial section with polymer-modified HF-150P emulsion, see the attached sketch.

About 87 11 25 Mr. J. Porter noted potholes at the centreline of the road with most of the potholing in the polymer section. The road was inspected on 87 12 09 by J. Carrick, R. McMaster (of McAsphalt Industries) J. Porter and myself.

We observed potholing at centreline over the 9.6 km, with 1.5 potholes per km in the lower control section, 8.3 per km in the polymer test section and 5.0 per km in the upper control section. A typical pothole was 10 to 30 cm wide by 10 m in length and all occurred along the centreline joint of the DST. The DST near the potholed sections was soft underfoot in the trial and control sections. Away from centreline, the DST was firm underfoot.

The weather had been mild over the preceding 3 days and it was raining during the inspection. Water could be seen ponding along centreline in many locations. The rain, spring thaw conditions and the trucks, no doubt, helped to contribute to the failure along centreline. We saw loaded tractor trailers travelling north and southbound. The traffic in both directions drove on the centreline. The AADT is 550 with approximately 12% commercial traffic.

Samples of the DST were cut from the road at several locations. At the distressed areas of the polymer emulsion, two distinct layers of surface treatment could be seen with loose aggregate sandwiched between the layers at centreline. The sandwich effect was less noticeable in control sections at centreline. Away from the centreline, the sandwich effect was not evident in the polymer or the control sections. This suggests that the construction of the centreline joint, especially in the polymer section, may have had some influence on the potholing.

The polymer emulsion was observed to break very quickly during construction. This prevents the emulsion from effectively wetting the fine aggregate and reduces the ability of the emulsion to penetrate upwards. The laboratory test results, attached, show high demulsibility and high sieve test results which indicate a very quick breaking emulsion.

R C Aquin

R.C Aquin
Supervising Inspector, Surface Treatments

for: D.F. Lynch
Head, Bituminous Section

DFL:RA

FIGURE 5: HWY. 575 POLYMER TEST SECTION, DECEMBER, 1987

FIGURE 6: HWY. 575
CONTROL SECTION
DECEMBER, 1987

DRAFT

SURFACE TREATMENT CONDITION RATING

Hwy. No. _____ District No. _____ Date _____

Location _____

_____

Distress	Rating[1]	Remarks
Potholing		
Alligator Cracking		
Bleeding		
Loss Of ST Aggregate		
Edge Breakage		
Total		
Average Rating [2]		

Comments _____

_____

_____

_____

_____

Compiled By _____

Notes: 1. See surface treatment condition ratings on page 2 of 2.
2. The Average Rating equals the Total divided by 14.

FIGURE 7: DRAFT CONDITION RATING FORM

SURFACE TREATMENT CONDITION RATINGS

DRAFT

POTHOLING

Circular holes in the surface treatment (ST).

	Rating
None	100
Occasional	80-99
Moderate: economical to patch.	60-79
Severe: patching becomes uneconomical.	20-59
Very severe: ST must be graded out.	0-19

ALLIGATOR CRACKING

Cracks forming a network of blocks 5 to 10 cm in size.

None	10
Ocassional	6-9
Moderate	4-6
Severe	2-4
Very severe	0-2

BLEEDING

The asphalt binder covers or nearly covers the ST aggregate.

None	10
Occassional	6-9
Moderate, frequently occurs in wheel tracks.	4-6
Severe	2-4
Very severe	0-2

LOSS OF ST AGGREGATE

Loss of ST aggregate; uniform loss and/or loss in specific areas.

None	10
Slight	6-9
Moderate	4-6
Severe	2-4
Very Severe	0-2

EDGE BREAKAGE

Loss of surface treatment aggregate along the edges.

None	10
Slight	6-9
Loss of ST up to 10 cm.	4-6
Loss of ST up to 30 cm.	2-4
Loss of ST over 30 cm.	0-2